Urban areas, especially those along large river basins, are the most vulnerable due to their dense population and older built environments. Ground transportation systems would also be vulnerable. They are old and lack earthquake resistant construction. Utilities such as power, water, sewage, gas, petroleum pipelines, and communications are extremely vulnerable. Very few systems were built with earthquake resistance as part of their design.

Vulnerability

If an earthquake of moderate strength should occur along any of these faults or systems of faults, there would be additional populations in the surrounding counties that would be affected. An earthquake of significant magnitude along any faults would be felt throughout the state and surrounding states. Damage in nearby states could limit response capabilities.

Human Services – Human Services Agencies with facilities within the affected area would face a triple onslaught. Their structure may be damaged. Personnel will be impacted as the general population. They will experience an overwhelming influx of patients and clients. The equipment and supplies lost because of damage to storage facilities, lack of communication, and damage to emergency vehicles and transportation routes will seriously tax their ability to respond during the emergency.

Transportation Exposure – The aging transportation infrastructure, its type of construction and the state topography will severely limit access to the area for some period of time. This will seriously hinder the initial recovery effort. Air traffic could be a means of accessing some parts of the affected areas. Without all of its roadways, bridges, and rail lines intact, affected areas will have limited access. The long reconstruction time of roadways, bridges and rail lines could critically impede the recovery efforts.

Other Infrastructure Exposure – The ground shaking and other geological effects such as liquefaction from an earthquake cause damage and destruction to above and below ground system components of utilities. Some changes may be permanent, i.e.; communities who depend on wells for water supply may lose those wells permanently for water supply because of geological changes. Damage to other utilities such as electrical, communications, sewer, ruptured gas lines can have cascading effects—lack of water distribution systems may hinder firefighting efforts and spread of communicable diseases due to damaged waste disposal systems.

Economic Exposure – A strong earthquake in the Central United States would have a devastating negative impact on the communities within the Central United States. The loss of personal property and the disruption of normal life for the area inhabitants would be compounded by the possible permanent loss of business and industry. Large portions of the population depend on community-based industries for employment and creation of goods and services that may not recover from the losses suffered as a result of such a quake.

Future Exposure

As the population grows, the infrastructure continues to age, and business continues as usual, future earthquake exposure will expand exponentially. Upgraded codes will protect newer construction. However, decreasing public interest in earthquake safety due to the relative inactivity of the fault systems presents a serious problem to overcome.

Loss Estimation

Loss Potential

- The lack of development and technology at the time of damaging earthquakes means there is little statistical and historical earthquake data from which to derive accurate information about the damage incurred in the region. However, by taking into account the damage that occurred in the 1811-1812 earthquakes and historical damage from other earthquakes of the late 1800's and 1900's, the scope and magnitude of such an event would be devastating to the impacted communities. The cost would likely exceed the cost of the 1994 Los Angeles earthquake. It is highly probable that the amount of assistance available to Indiana from state and federal sources would be inadequate to return economic life to its pre-earthquake condition. The length of recovery process from such a quake would also most likely have a negative impact on those few individuals who suffered little or negligible damage as a result of the shaking.

- The loss from a strong-magnitude earthquake within or near the Indiana borders could affect most if not all of the state. Because of the lack of retrofitting and inadequate earthquake resistant design, the transportation infrastructure damage from a quake along the seismic zones would be unprecedented in the state. Indiana is crossroads for major intrastate systems. Damage to these roads would impede disaster response and recovery efforts, and impact the economic stability of the state.
- Damage from a major earthquake along the New Madrid, Wabash Valley or Western Ohio Seismic Zones would far exceed that caused by any of the tornadoes, floods or transportation disasters that the state has experienced.

Potential Impact of No Action – The lack of public awareness, the lack of enforcement of the stricter earthquake resistant building code and continued growth of population and urbanization increase the potential loss and slow the recovery process from a major earthquake. The declining public interest in earthquake preparedness and mitigation is a serious problem the state must overcome.

Recognizing these problems, the Federal Emergency Management Agency, seven state emergency management agencies and other organizations joined efforts and formed the Central United States Earthquake Consortium (CUSEC). CUSEC formed in 1983, with member states of Indiana, Illinois, Kentucky, Tennessee, Arkansas, Mississippi and Missouri. Alabama was added in 2003 as a charter state.

- Coordinates multi-state planning, mitigation and encourages research in earthquake hazard reduction.
- Coordinates efforts with the state earthquake program managers, state department of transportation and operations chiefs.

United States Geological Survey (USGS) in 1990 advised by private and government experts issued a plan for:

- Intensified study of the New Madrid Seismic Zone. At the same time, the National Earthquake Hazards Reduction Program expanded efforts in the Central United States.

- Earthquake education is now part of the curriculum in the schools of many CUSEC states.
- In 1993, with USGS support and collaboration, the CUSEC state geologists began a significant effort to map earthquake hazards. In 1995 they completed a regional soils map that can be used to locate areas likely to experience shaking in earthquakes.
- Most CUSEC states have adopted building codes containing modern earthquake design standards.
- Efforts to ensure the seismic safety of critical structures such as dams, bridge and highway systems have accelerated.

Strong earthquakes in the Central United States are certain to occur in the future. In contrast to the Western United States, the causes and effects of earthquakes in the Central and Eastern United States are just beginning to be understood. Through better understanding of earthquake hazards and through public education, earth scientists and engineers are helping to protect the citizens of all parts the United States from loss of life and property on future earthquakes.

HAZUS & ATC-21

Earthquake Loss estimates are forecasts of damage and human and economic impacts that may result from future earthquakes. They are not precise predictions, but rather estimates based on current scientific and engineering knowledge. Hazards U.S. (HAZUS) and Applied Technology Council-21 (ATC-21) represent an interesting technology in the risk assessment of earthquake occurrence and building vulnerability.

The FEMA HAZUS loss estimation methodology is a software program that uses mathematical formulas and information about building stock, local geology and the location and size of potential earthquakes, economic data, population and other information to estimate losses from a potential earthquake. Once the location and size of a hypothetical earthquake is identified, HAZUS will estimate the violence of ground shaking, the number of buildings damaged the number of casualties, amount of damage to transportation systems as well as utilities, displaced persons and estimate cost of repairing projected damage.

ATC-21 is a rapid seismic evaluation of critical facilities along with a database that stores and tracks that information. It is a method to evaluate already constructed buildings for seismic and risk vulnerability. In addition, IDHS is encouraging communities in seismic risk areas to be trained in HAZUS and ATC-21 data collection. HAZUS and ATC-21 are very compatible; the information that ATC-21 generates is the same information used in HAZUS for vulnerability and risk monitoring.

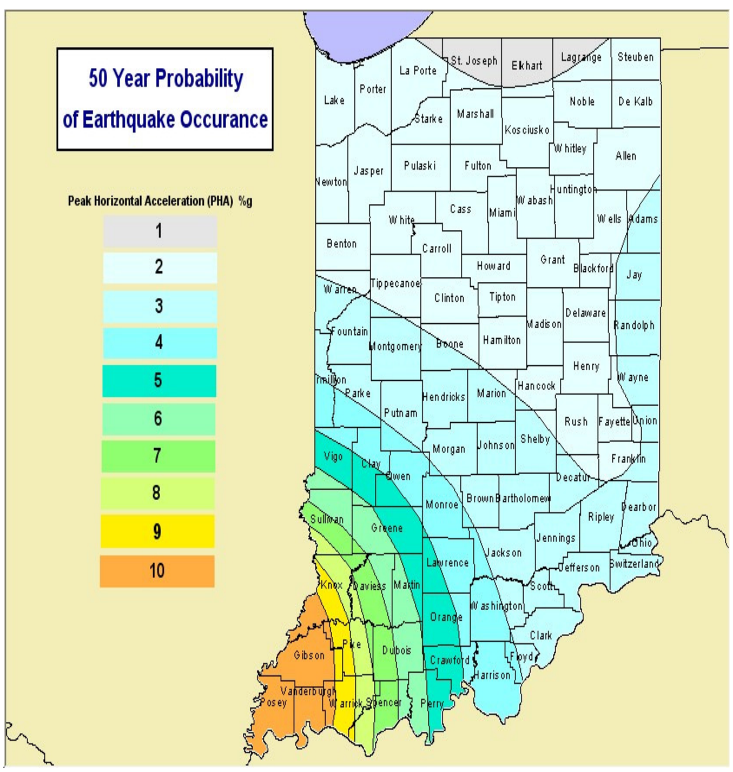
MERCALI SCALE	CHARACTERISTIC EFFECTS	RICHTER SCALE	
		WESTERN US	EASTERN US*
I INSTRUMENTAL	Detected only by seismography.	3.5 – 4.2	
II FEEBLE	Noticed only by sensitive people		
III SLIGHT	Like the vibrations caused by a heavy truck passing. Felt by people at rest, especially on upper floors.		
IV MODERATE	Felt by people while walking. Objects rock – including standing vehicles.	4.3 – 4.8	
V RATHER STRONG	Felt generally. Most sleepers are awakened.		
VI STRONG	Trees sway. Suspended objects swing. Loose objects overturn or fall.	4.9 – 5.4	4.3 – 4.8
VII VERY STRONG	General alarm. Walls crack. Plaster falls.	5.5 – 6.1	4.9 – 5.4
VIII DESTRUCTIVE	Masonry cracks. Chimneys fall. Poorly constructed buildings damaged. Water well levels may change.	6.2 – 6.9	4.9 – 5.4
IX RUINOUS	Houses collapse where ground begins to crack. Pipes break open.		5.5 – 6.1
X DISASTEROUS	Ground cracks badly. Many buildings destroyed and railway lines bent. Landslides on steep slopes.	7.0 – 7.3	6.5
XI VERY DISASTEROUS	Few buildings remain standing. Bridges destroyed. All services (railway lines, water-sewage pipes, and TV-phone cables) out of action. Great landslides and floods.	7.4 – 8.1	6.5
XII CATASTROPHIC	Total destruction. Objects thrown into air. Ground rises and falls in waves.	8.1	6.5

Source: **Stover and Coffman, 1993**

EARTHQUAKE AT RISK POPULATION		
SEISMIC ZONE/FAULT	**AT RISK POPULATION**	
NEW MADRID SEISMIC	1,455,801	
WESTERN OHIO SEISMIC (PRIMARY)*	526,497	
WESTERN OHIO (SECONDARY)*	36,026	
WABASH VALLEY FAULT	2,123,397	
	Total	**4,141,721**

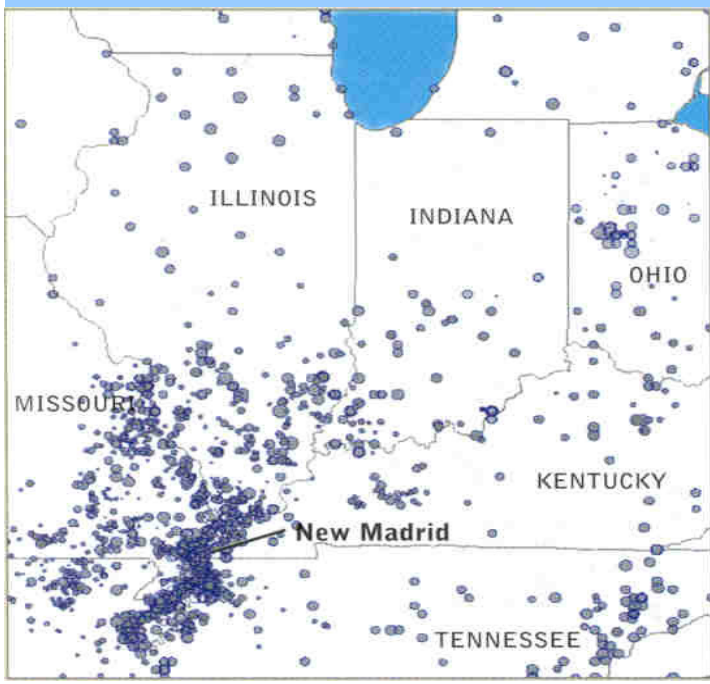
- Primary counties are those that will be most affected •

50 Year Earthquake Occurrence Probability



Graphic shows the peak horizontal acceleration experienced during an earthquake with a 50 year return period.

Central U.S. Historical Earthquakes



3.3 Assessing Vulnerability by Jurisdiction

The matrix below summarizes the vulnerability by Jurisdiction on a County basis for five hazards that are outlined above. The State of Indiana used historical data and models, such as HAZUS-MH, to determine the vulnerability of the various jurisdictions. (See Section 5.3 for the status of local plans.) The communities with the Highest vulnerability are the most likely to experience the identified hazard and are the ones to experience the greatest damage to structures. Because of the lack of enforceable building code and construction inspection it is difficult to distinguish which structures are more resistant to tornadoes, wind and snow storms. We can generalize that homes in the northern third are least likely to suffer damage from snowstorms, but they are more likely to experience heavy snows. Conversely, homes and structures in the southern third of the state are more likely to suffer damage due to snow load, but are also less likely to experience heavy snows. Additionally, communities that have adopted the International Building Code are more resistant to the damages from wind, snow and earthquake. However, in Indiana the greatest risk of residents and structures is the loss of essential services such as electricity, natural gas and water resources all of which are highly vulnerable to winter storms, earthquakes and to a limited extent tornadoes and flood.

Few structures if any can withstand the direct impact of a tornado of F-4 or greater. Only those areas constructed as shelters for tornadoes have withstood such direct impact. However, it is not cost effective to build all structures to withstand such winds. Therefore, all structures in Indiana are vulnerable to tornadoes, and all areas of the state appear to have an equal probability of experiencing tornadoes. The country's "tornado alley" extends into the state of Indiana.

The Earthquake Annualized Loss generated as a result of a statewide earthquake analysis is contained in Appendix VI by county and the state. The annualized probability was done by running a 50, 500 and 2500 year return earthquake. These reports were determined by using HAZUS earthquake model with the default data. The state strategic planning section is working on the national exercise for the 100th anniversary of the New Madrid Earthquakes. The plans for the exercise should produce better, more accurate data on risk and vulnerability of state and local jurisdictions. This data when finalized will hopefully provide a better understanding of possible vulnerability to earthquakes in Indiana.

Appendix VI contains a DVD with the Data from the annualized HAZUS modeling done at a Level 1. Also in Appendix VI is a copy of the Statewide Flood Risk Assessment. This assessment directly addresses each county's flood risks and vulnerabilities. The Flood Risk Assessment provides baseline flood data developed through a national process and is a very valuable tool to learn the status of flood risk information available within each county. For each County, several categories of information are summarized based on existing knowledge. They are: hazard identification, asset inventory, general building stock losses, essential facility losses and State of Indiana property losses. For example, in Allen County, dates and locations of flood insurance reports and engineering studies are listed along with a brief summary of flood risk and flood mitigation projects. Allen Country assets were analyzed using HAZUS-MH. Building stock losses and essential facility losses are estimated for the 100 year flood risk. No State property losses are identified for this County.

As State of Indiana local plans are being researched and written, geographically specific information is becoming available. This information will provide more accurate building values, more detail on locally practiced construction techniques and more accurate structure inventory. It is anticipated that the improved data will be available and included as the next level of detail for the Statewide Flood Risk Assessment. The information will be included in the next revision of the State Plan.

The hazard vulnerability matrix below was reviewed by the planning team. Team members concluded that the information remains fundamentally unchanged from the 2004 plan for two reasons. First, it is still early in the third year of the previously approved plan. State populations have not changed significantly in that time period. Secondly, because most local plans are still in process, there is insufficient changed detail to affect the information provided in the table.

Hazard Vulnerability by County

COUNTY	FLOODING				TORNADOES				EARTHQUAKES				WINTER STORMS			
	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability
ADAMS	12.30	4,061	24	**H**	100	33,592	24	**H**	1.63	33,592	24	**L**	100	33,592	24	**M**
ALLEN	5.94	20,253	175	**H**	100	340,153	175	**H**	1.07	340,153	175	**L**	100	340,153	175	**M**
BARTHOLOMEW	9.50	7,194	59	**H**	100	72,341	59	**H**	2.64	72,341	59	**L**	100	72,341	59	**M**
BENTON	3.05	276	18	**H**	100	9,189	18	**H**	1.62	9,189	18	**L**	100	9,189	18	**M**
BLACKFORD	0.63	82	13	**H**	100	13,867	13	**H**	1.27	13,867	13	**L**	100	13,867	13	**M**
BOONE	7.48	3,809	44	**H**	100	49,370	44	**H**	2.05	49,370	44	**L**	100	49,370	44	**M**
BROWN	9.52	1,267	14	**H**	100	15,316	14	**H**	2.8	15,316	14	**L**	100	15,316	14	**M**
CARROLL	48.14	8,819	16	**H**	100	20,499	16	**H**	1.26	20,499	16	**L**	100	20,499	16	**M**
CASS	36.10	15,361	30	**H**	100	40,415	30	**H**	1.11	40,415	30	**L**	100	40,415	30	**M**
CLARK	8.78	7,744	103	**H**	100	99,482	103	**H**	3.38	99,482	103	**M**	100	99,482	103	**M**
CLAY	3.33	280	38	**H**	100	26,772	38	**H**	5.39	26,772	38	**M**	100	26,772	38	**M**
CLINTON	8.58	2,830	29	**H**	100	33,947	29	**H**	1.58	33,947	29	**L**	100	33,947	29	**M**
CRAWFORD	6.70	498	13	**H**	100	11,146	13	**H**	6.34	11,146	13	**M**	100	11,146	13	**M**
DAVIES	2.36	563	33	**H**	100	30,047	33	**H**	10.01	30,047	33	**H**	100	30,047	33	**M**
DEARBORN	3.55	1,413	43	**H**	100	47,849	43	**H**	1.83	47,849	43	**L**	100	47,849	43	**M**
DECATUR	15.62	3,857	56	**H**	100	24,747	56	**H**	2.17	24,747	56	**L**	100	24,747	56	**M**
DEKALB	20.68	8,226	35	**H**	100	41,129	35	**H**	0.87	41,129	35	**L**	100	41,129	35	**M**
DELAWARE	4.00	4,090	102	**H**	100	117,488	102	**H**	1.35	117,488	102	**L**	100	117,488	102	**M**
DUBOIS	2.62	895	62	**H**	100	40,200	62	**H**	9.89	40,200	62	**M**	100	40,200	62	**M**
ELKHART	3.78	6,652	120	**H**	100	188,779	120	**H**	0.76	188,779	120	**L**	100	188,779	120	**M**

COUNTY	FLOODING				TORNADOES				EARTHQUAKES				WINTER STORMS			
	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability
FAYETTE	15.97	4,075	23	**H**	100	24,999	23	**H**	1.46	24,999	23	**L**	100	24,999	23	**M**
FLOYD	3.41	2,776	81	**H**	100	71,148	81	**H**	3.65	71,148	81	**L**	100	71,148	81	**M**
FOUNTAIN	32.52	5,978	19	**H**	100	17,750	19	**H**	2.55	17,750	19	**L**	100	17,750	19	**M**
FRANKLIN	3.66	704	13	**H**	100	22,773	13	**H**	1.67	22,773	13	**L**	100	22,773	13	**M**
FULTON	29.56	5,174	24	**H**	100	20,508	24	**H**	0.93	20,508	24	**L**	100	20,508	24	**M**
GIBSON	3.66	1,032	45	**H**	100	32,991	45	**H**	15.64	32,991	45	**H**	100	32,991	45	**M**
GRANT	15.61	10,968	83	**H**	100	71,572	83	**H**	1.21	71,572	83	**L**	100	71,572	83	**M**
GREENE	2.74	641	28	**H**	100	33,244	28	**H**	7.31	33,244	28	**M**	100	33,244	28	**M**
HAMILTON	4.06	6,847	95	**H**	100	216,826	95	**H**	1.7	216,826	95	**L**	100	216,826	95	**M**
HANCOCK	27.13	15,162	42	**H**	100	59,446	42	**H**	1.68	59,446	42	**L**	100	59,446	42	**M**
HARRISON	3.76	1,034	40	**H**	100	35,706	40	**H**	5	35,706	40	**L**	100	35,706	40	**M**
HENDRICKS	24.78	26,391	68	**H**	100	118,850	68	**H**	2.45	118,850	68	**L**	100	118,850	68	**M**
HENRY	15.34	7,303	46	**H**	100	47,699	46	**H**	1.41	47,699	46	**L**	100	47,699	46	**M**
HOWARD	23.76	20,503	55	**H**	100	84,880	55	**H**	1.28	84,880	55	**L**	100	84,880	55	**M**
HUNTINGTON	34.90	13,226	50	**H**	100	38,143	50	**H**	1.08	38,143	50	**L**	100	38,143	50	**M**
JACKSON	9.61	3,827	45	**H**	100	41,639	45	**H**	3.12	41,639	45	**M**	100	41,639	45	**M**
JASPER	15.12	4,306	19	**H**	100	31,078	19	**H**	1.22	31,078	19	**L**	100	31,078	19	**M**
JAY	22.81	5,072	19	**H**	100	21,372	19	**H**	1.81	21,372	19	**L**	100	21,372	19	**M**
JEFFERSON	3.99	901	42	**H**	100	32,250	42	**H**	2.5	32,250	42	**L**	100	32,250	42	**M**
JENNINGS	7.70	2,165	24	**H**	100	28,111	24	**H**	2.77	28,111	24	**L**	100	28,111	24	**M**
JOHNSON	2.88	3,258	76	**H**	100	123,256	76	**H**	2.39	123,256	76	**L**	100	123,256	76	**M**
KNOX	2.54	653	50	**H**	100	38,745	50	**H**	13.19	38,745	50	**H**	100	38,745	50	**M**

COUNTY	FLOODING				TORNADOES				EARTHQUAKES				WINTER STORMS			
	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability
KOSCIUSKO	14.07	6,925	67	**H**	100	75,301	67	**H**	0.91	75,301	67	**L**	100	75,301	67	**M**
LAGRANGE	10.56	3,648	32	**H**	100	36,026	32	**H**	0.77	36,026	32	**L**	100	36,026	32	**M**
LAKE	8.78	39,380	428	**H**	100	487,476	428	**H**	1.18	487,476	428	**L**	100	487,476	428	**M**
LAPORTE	3.00	2,672	95	**H**	100	109,878	95	**H**	0.86	109,878	95	**L**	100	109,878	95	**M**
LAWRENCE	5.66	2,453	31	**H**	100	46,201	31	**H**	5.46	46,201	31	**M**	100	46,201	31	**M**
MADISON	24.42	33,093	79	**H**	100	131,121	79	**H**	1.33	131,121	79	**L**	100	131,121	79	**M**
MARION	5.71	47,743	588	**H**	100	863,251	588	**H**	2.2	863,251	588	**L**	100	863,251	588	**M**
MARSHALL	17.70	8,542	47	**H**	100	46,352	47	**H**	0.86	46,352	47	**L**	100	46,352	47	**M**
MARTIN	17.60	1,796	61	**H**	100	10,347	61	**H**	7.99	10,347	61	**M**	100	10,347	61	**M**
MIAMI	36.07	12,880	31	**H**	100	36,177	31	**H**	1.11	36,177	31	**L**	100	36,177	31	**M**
MONROE	2.20	1,466	91	**H**	100	122,903	91	**H**	4.68	122,903	91	**M**	100	122,903	91	**M**
MONTGOMERY	11.62	4,232	36	**H**	100	37,911	36	**H**	2.69	37,911	36	**L**	100	37,911	36	**M**
MORGAN	10.26	7,455	44	**H**	100	68,656	44	**H**	2.81	68,656	44	**L**	100	68,656	44	**M**
NEWTON	14.70	1,982	20	**H**	100	14,403	20	**H**	1.32	14,403	20	**L**	100	14,403	20	**M**
NOBLE	9.65	5,019	32	**H**	100	47,039	32	**H**	0.85	47,039	32	**L**	100	47,039	32	**M**
OHIO	7.95	385	7	**H**	100	5,732	7	**H**	1.92	5,732	7	**L**	100	5,732	7	**M**
ORANGE	2.94	565	7	**H**	100	19,616	7	**H**	6.55	19,616	7	**M**	100	19,616	7	**M**
OWEN	8.20	1,570	11	**H**	100	22,827	11	**H**	4.93	22,827	11	**M**	100	22,827	11	**M**
PARKE	35.65	5,539	18	**H**	100	17,329	18	**H**	4.1	17,329	18	**M**	100	17,329	18	**M**
PERRY	7.67	1,242	26	**H**	100	18,717	26	**H**	4.81	18,717	26	**M**	100	18,717	26	**M**
PIKE	1.49	151	14	**H**	100	12,931	14	**H**	12.76	12,931	14	**H**	100	12,931	14	**M**
PORTER	14.64	20,093	91	**H**	100	152,533	91	**H**	1.05	152,533	91	**L**	100	152,533	91	**M**

COUNTY	FLOODING				TORNADOES				EARTHQUAKES				WINTER STORMS			
	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability
POSEY	7.98	1,872	61	**H**	100	26,876	61	**H**	12.91	26,876	61	**H**	100	26,876	61	**M**
PULASKI	36.76	4,734	14	**H**	100	13,835	14	**H**	1.16	13,835	14	**L**	100	13,835	14	**M**
PUTNAM	8.25	4,137	40	**H**	100	36,692	40	**H**	3.83	36,692	40	**L**	100	36,692	40	**M**
RANDOLPH	15.29	4,121	38	**H**	100	26,833	38	**H**	1.43	26,833	38	**L**	100	26,833	38	**M**
RIPLEY	5.36	1,345	39	**H**	100	27,316	39	**H**	2.02	27,316	39	**L**	100	27,316	39	**M**
RUSH	23.22	4,214	16	**H**	100	18,016	16	**H**	1.72	18,016	16	**L**	100	18,016	16	**M**
ST JOSEPH	16.72	42,603	175	**H**	100	266,348	175	**H**	0.72	266,348	175	**L**	100	266,348	175	**M**
SCOTT	2.67	582	6	**H**	100	23,556	6	**H**	2.97	23,556	6	**L**	100	23,556	6	**M**
SHELBY	35.37	15,345	32	**H**	100	43,717	32	**H**	2.06	43,717	32	**L**	100	43,717	32	**M**
SPENCER	11.40	2,252	31	**H**	100	20,343	31	**H**	12.14	20,343	31	**H**	100	20,343	31	**M**
STARKE	7.37	1,998	19	**H**	100	23,139	19	**H**	0.96	23,139	19	**L**	100	23,139	19	**M**
STEUBEN	17.88	4,155	23	**H**	100	33,706	23	**H**	0.82	33,706	23	**L**	100	33,706	23	**M**
SULLIVAN	2.16	449	21	**H**	100	21,861	21	**H**	8.32	21,861	21	**M**	100	21,861	21	**M**
SWITZERLAND	7.49	487	14	**H**	100	9,435	14	**H**	1.4	9,435	14	**L**	100	9,435	14	**M**
TIPPECANOE	11.15	16,837	65	**H**	100	154,848	65	**H**	1.57	154,848	65	**L**	100	154,848	65	**M**
TIPTON	21.70	3,781	19	**H**	100	16,422	19	**H**	1.27	16,422	19	**L**	100	16,422	19	**M**
UNION	22.26	1,472	6	**H**	100	7,238	6	**H**	1.49	7,238	6	**L**	100	7,238	6	**M**
VANDERBURGH	8.43	14,010	158	**H**	100	171,889	158	**H**	18.67	171,889	158	**H**	100	171,889	158	**M**
VERMILLION	31.37	5,146	22	**H**	100	16,572	22	**H**	4.14	16,572	22	**M**	100	16,572	22	**M**
VIGO	3.11	2,885	77	**H**	100	104,540	77	**H**	6.46	104,540	77	**M**	100	104,540	77	**M**
WABASH	36.38	12,888	41	**H**	100	34,339	41	**H**	1.08	34,339	41	**L**	100	34,339	41	**M**
WARREN	44.82	3,883	13	**H**	100	8,703	13	**H**	2.18	8,703	13	**L**	100	8,703	13	**M**

COUNTY	FLOODING				TORNADOES				EARTHQUAKES				WINTER STORMS			
	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability	% of structures exposed	Population affected	Critical Facilities	Vulnerability
WARRICK	4.38	2,107	57	**H**	100	54,744	57	**H**	12.48	54,744	57	**H**	100	54,744	57	**M**
WASHINGON	4.35	1,249	17	**H**	100	27,618	17	**H**	4.47	27,618	17	**M**	100	27,618	17	**M**
WAYNE	25.60	17,818	65	**H**	100	70,235	65	**H**	1.47	70,235	65	**L**	100	70,235	65	**M**
WELLS	16.62	4,491	20	**H**	100	27,912	20	**H**	1.28	27,912	20	**L**	100	27,912	20	**M**
WHITE	48.56	9,068	22	**H**	100	24,852	22	**H**	1.24	24,852	22	**L**	100	24,852	22	**M**
WHITLEY	9.40	3,069	32	**H**	100	31,651	32	**H**	0.94	31,651	32	**L**	100	31,651	32	**M**
STATEWIDE	11.10	635,995	5013	**H**	100	6,195,643	5013	**H**	3.45	6,195,643	5,013	**L**	100	6,195,643	5,013	**M**

Vulnerability H=High; M=Moderate; L=Low

The vulnerability listing for the above hazards is also used as the probability listing for each community for each hazard. Those with a high vulnerability also have the greatest probability of the event occurring within the community. The same holds true for communities with medium and low vulnerabilities, their probabilities match the vulnerability rating.

Average recurrence intervals for May-June 2004 floods in Indiana

Stream and Station			Peak discharge	Date	Average recurrence interval, in years		
Name	Lat.	Long.	(ft^3/sec) 1		Ranking 2	Curve 3	Use
Ohio River							
at Cannelton 4	37.89944	-86.70556	520,000	6/02		2	2
Wabash River							
at Covington	40.14000	-87.40556	72,000	6/14	5.3	10	10
at Lafayette	40.42194	-86.89694	54,200	6/13	2.4	<10	3
at Peru	40.74306	-86.09583	14,000	6/12	1.4	<10	1.4
White River							
at Newberry	38.92750	-87.01139	19,000	6/20	1.1	<10	1.5
at Spencer	39.28083	-86.76222	Gage Ht. = 19 ft	6/18	1.7	..	1.5
at Noblesville	40.04722	-86.01667	8,600	6/12	1.5	<10	1.5
E. Fork White River							
at Shoals	38.66722	-86.79222	24,000	5/28	1.2	<10	1.2
Mill Creek							
near Cataract	39.43333	-86.76333	3,400	6/01	1.2	..	1.2
Wildcat Creek							
nr. Lafayette	40.44056	-86.82917	16,800	6/12	5.0	<10	5
S. Fork Wildcat Creek							
nr. Lafayette	40.41778	-86.76806	10,200	6/11	7.9	13	13
Eel River							
nr. Logansport	40.78194	-86.26389	9,100	6/15	3.2	<10	3

Average recurrence intervals for May-June 2004 floods in Indiana

Stream and Station			Peak discharge	Date	Average recurrence interval, in years		
Name	**Lat.**	**Long.**	**(ft^3/sec) 1**		**Ranking 2**	**Curve 3**	**Use**
Mid. Fork Anderson River							
at Bristow	38.13889	-86.72111	1,100	5/26	1.7	…	1.7
Buck Creek							
nr New Middletown	38.12028	-86.08806	6,400	5/28	3.6	…	4
Whiskey Run							
at Marengo	38.37556	-86.34472	about 1050 5	5/28	3.0	<10	3
Blue River							
near White Cloud	38.43389	-86.19167	>16,000		..	..	150
at Fredericksburg	38.43389	-86.19167	24,000	5/28	18.5	>100	200
West Fork Blue River							
at Salem	38.60528	-86.09444	6,900	5/27	17.5	…	100
Silver Creek							
nr Sellersburg	38.37083	-85.72639	8,800	5/28	5.7	<10	6

FEMA, E A Prych, 5 July 2003

1 Discharge from the web, USGS real-time data (subject to revision)
2 Recurrence interval from ranking annual peak discharges available on the web; USGS.
3 Recurrence interval from curves in report on web;
www.state.in.us/dnr/water/surface_water/coordinated_discharges/index.html
4 Discharge and recurrence interval from M.S. Griffin (USGS, 7/2/2004 e-mail)
5 Discharge from observed gage height (7.1ft) and rating curve from annual peaks 1987-1993

3.4 Assessing Vulnerability of State Facilities

The vulnerability assessment to state facilities is dependant upon the catalogue of state facilities and land holdings, their location, and their value (Outside of roads, bridges, equipment, etc.). In the process of developing the risk assessment, IDHS realized that data did not exist in a format that would be easily accessed, and that could be used to determine the vulnerability. At the same time several agencies and the Department of Administration began to realize that this information was not readily available.

Since the 2005 version of this plan, the State GIS committee has gone a long way in mapping state critical facilities. Most have been mapped on a GIS layer, but, the GIS layers assign no replacement cost to the facilities. For planning purposes, the Indiana Department of Homeland Security was able to secure the locations of 576 state owned facilities. These structures house State Hospital Facilities, Correctional Facilities, State Parks and Department of Natural Resources Facilities, Department of Transportation Facilities, State Police Posts, National Guard Armories, Military Bases and one chemical depot. The Family and Social Services facilities listed are predominantly leased facilities. However, due to fiscal constraints and proximity to potential clients, many of these facilities are located within the floodplain and these are susceptible to contents damages due to flooding. The chart below is a summary of the number of state facilities located in each of the Homeland Security Districts by Agency. **Appendix III** contains maps of the state critical facilities by Homeland Security Planning District. The appendix also contains additional maps showing a representation of the floodplains and tornado tracks in relationship to state critical facilities.

Summary of State Owned Facilities

District	State Hospital	Correctional Facilities	Department of Natural Resources	Family & Social Services Administration	Department of Transportation	State Police Post	National Guard Armory	Military Base	Chemical Depot
1	0	7	8	18	5	1	7	0	0
2	0	4	15	16	5	2	4	0	0
3	0	7	25	18	4	2	7	1	0
4	1	2	8	14	7	1	9	0	0
5	1	16	15	37	6	6	11	3	0
6	1	9	17	27	2	2	12	0	0
7	0	5	16	12	3	2	8	1	1
8	0	2	17	14	4	2	6	2	0
9	3	2	21	15	4	3	4	2	0
10	2	2	25	22	5	2	5	1	0
TOTAL	**8**	**56**	**167**	**193**	**45**	**23**	**73**	**10**	**1**

In an attempt to get a better idea of the replacement value of the state facilities we began contacting state agencies. Agencies which "own" their facilities maintain information on replacement value. The agencies which fall into these categories are Indiana Department of Transportation, Department of Corrections, Military Department and Department of Natural Resources. Other agencies lease facilities from the Department of Administration or in the case of FSSA, private firms. These agencies are housed in large, multi agency structures, such as the State Campus in Indianapolis.

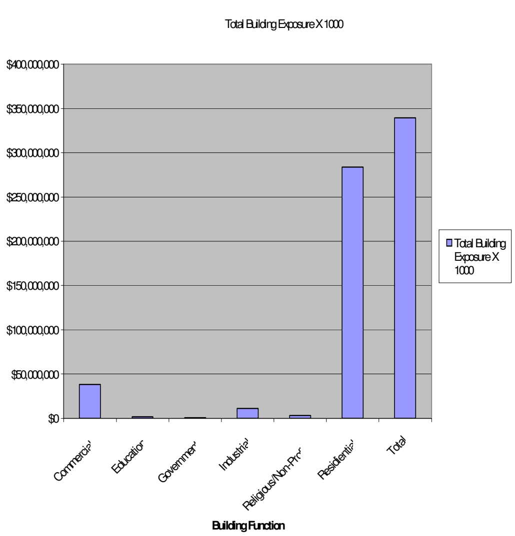
The Indiana Department of Transportation (INDOT) recently conducted a Risk Assessment for their roads and bridges. A summary table listing the bridges and their replacement costs may be found in Appendix 3. In addition, a map showing the major facilities owned by INDOT and the associated replacement costs may also be found in Appendix 3.

The Indiana Department of Homeland Security has contacted a number of agencies directly to access similar data for their facilities and IDHS plans to update this information within the plan as data becomes available. This information will also be tied into the new level of risk assessment that is outlined in Action Item 3, located in Section 4.3.1 of this plan.

3.5 Estimating Potential Losses by Jurisdiction

The Mitigation division in order to determine the potential losses by local jurisdiction used HAZUS MH for earthquakes. The results are based on a level 1 run and are contained in Appendix I.

IDHS and the Polis Center are working on improvements to the flood estimation of potential losses using HAZUS. In 2005, a level one analysis was run for all 92 Counties. The information on the flood risk and vulnerability is based largely on this information. We have seen that as we have secured better local data and technical data i.e. better DEM and flood grids to import into HAZUS, we have gotten more accurate data. The State anticipates that this information for flooding, tornadoes, winds, winter storms, etc. will be included in the States Enhanced Plan. IDHS received a PDM Grant to develop this information. The state and local governments will continue to assess the vulnerability of critical facilities as more and more communities complete their mitigation plans.



The Agricultural Declarations Table is located in **Appendix III** gives a broad view on how natural hazards affect nearly one-half of the Indiana economy. This portion of the state's economy is widely affected on an annual basis by the natural hazards. Fortunately, large portions of this "industry" are protected by available Federal Insurance programs.

3.5a Changes in development for jurisdictions in hazard prone areas *(2008 Update)*

Three hazard prone areas have been selected to be reviewed at greater depths for this planning effort. These three areas best depict the issues related to the three most significant hazards, floods, tornados and earthquakes. The entire state is susceptible to each of the three hazards; in each case the area selected for further elaboration is representative of the other jurisdictions that are impacted by each of the hazards.

Overall statistically, the state of Indiana has grown in population by an average of 9.4%. Each of the areas identified below have similar or greater growth rates. Increases in population and development of the area for new industries and job growth require these communities take a proactive stance on their development processes to mitigate potential hazard issues before they arise.

The Maumee River Basin area exemplifies the flood hazards throughout the state. Made up of 5 counties, the river basin includes both the heavily industrial and residential areas within Fort Wayne and Allen County as well as the smaller home town communities in the more rural counties of Adams, Steuben, Noble and DeKalb. 6.9 % of the new residential construction permits issued in 2006, the latest statistics available, were issued for the Maumee River Basin member Counties. The communities within the river basin have focused their efforts on limiting growth near the rivers traversing the area and closely examining the watershed burdens placed upon the rivers due to new growth. Statewide this is reflected in the number of detention basins being installed to limit the amount of water that is immediately discharged to the rivers and lakes.

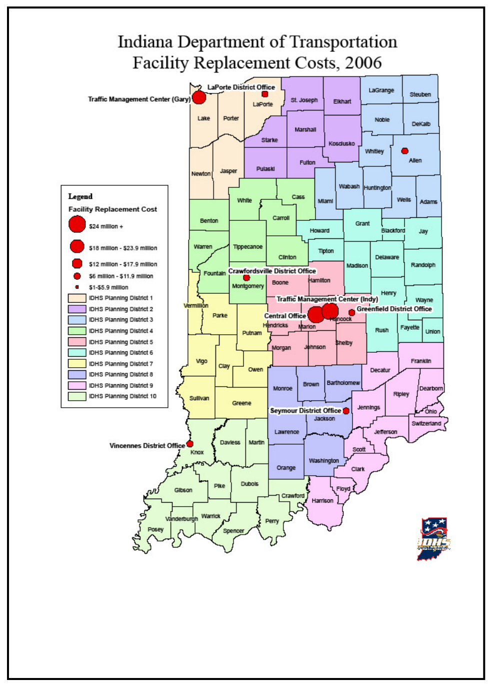
The Indianapolis Metropolitan area includes Marion, Morgan, Johnson, Hancock, Hamilton, Hendricks, Boone and Shelby Counties. These counties encompass the largest growth area with 38.2% of the states new residential building permits for 2006. This area also is frequented by tornados that traverse the state. The greatest push in this area is for better notification of potential tornadic weather events, since building location will not prevent tornados.

The last area to be focused upon is the City of Evansville Metropolitan area and Vanderburgh County. The southwestern corner of the state where the City of Evansville and Vanderburgh County are located is a bit slower growing area. Yet the three counties making up the region, Posey, Vanderburgh and Warrick, still boast an increase of 4% of the new home building permits in 2006. This growth is encouraged but with some restrictions. The Vanderburgh County Commissioners passed an ordinance requiring enhanced anchoring of mobile and manufactured housing to limit the amount of damage during an earthquake or a tornado. Many of the public structures have been retrofitting gas valves and other utility connections in an attempt to reduce damage caused in the event of an earthquake. The Evansville Metropolitan area has been working closely with the Central United States Earthquake Consortium (CUSEC) in educating the community about the earthquake hazard and in developing realistic plans to address this situation when it occurs.

3.5b Effect of changes in development on loss estimates *(2008 Update)*

The changes in development have in many cases increased the loss estimations, due to the numbers of new structures being added to the inventory for each of the areas. In addition, the multi-hazards mitigation planning efforts have allowed the state to begin acquiring realistic data from the county assessor's offices, thus enhancing the actual damage calculations. This effort should near completion with the next State Plan revision in 2011.

3.6 Estimating Potential Losses of State Facilities



The mitigation division will work with the IDNR division of water to complete an assessment of the state facilities at risk for flood damage, INDOT to assess infrastructure such as roads, bridges, etc to earthquake. Most of the state facilities especially those that are housed in leased office space are equally susceptible to tornado, wind and winter storm. Agencies with large number of leased facilities are those that provide direct services, such as Family and Social Services and Bureau of Motor Vehicles. With leased facilities, the potential losses are related to office furnishings and lost work hours. We continue to work with additional agencies to secure replacement cost information.

IDHS has replacement costs and locations of the most critical INDOT facilities and bridges. This information is the result of a vulnerability study completed as part of INDOT's Continuity of Operations Plan. The Study gave replacement cost of a sampling of bridges and detour times related to the rerouting of emergency services, and the replacement of 16 facilities. This would allow us to determine by type and size the possible replacement of a bridge or type of facility. We will continue working with INDOT to enhance the data from their agency and will work actively with the Indiana Department of Corrections, Department of Natural Resources and State Police to gather data on their critical facilities, as well. See **Appendix III** for the maps showing state facilities and their vulnerability.